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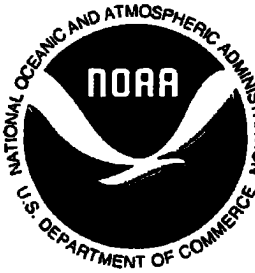

Microwave Humidity Sounder (MHS) Level 1b Format Specification for NOAA-N and the IJPS Era

Version 1.4

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1 Introduction

This document describes the MHS Level 1b format for the IJPS era, which includes the NOAA-N/N' satellites and the Metop satellites. It provides Level 1b format specifications for the primary header record and the three types of data records. Please note that as part of the updates to the Level 1b formats for NOAA-N and the IJPS era is the inclusion of additional, or secondary, header records. They will contain ancillary data set names and any metadata needed for, primarily, reprocessing. Currently, the content and format of any secondary header record is TBD. Applications that will access MHS Level 1b data sets should use the "Count of Header Records in this Data Set" field, located in the first, or primary, header record, to calculate the position of the first data record and skip the secondary header records.

Although the MHS is a new instrument, it shares some commonality with the AMSU-B instrument. Therefore, similarities with the AMSU-B Level 1b format were maintained as much as possible. For example, a number of MHS Level 1b fields that are similar to AMSU-B Level 1b fields (e.g., calibration coefficients, earth location data, earth FOV counts) have the same byte offsets as their corresponding AMSU-B fields. Also, based on the format given in this document, the MHS Level 1b record length is 3,072 bytes, which is the same as the AMSU-B Level 1b record length. However, in addition to some obvious telemetry differences, nomenclature used by the instrument manufacturer in MHS documentation is used in this document for consistency. For example, the channels are referred to as H1, H2, H3, H4, and H5, as opposed to 16, 17, 18, 19, and 20, respectively, as is the case for AMSU-B.

2 Applicable Documents

Table 1 presents a list of applicable documents (AD-#).

Doc #	Title	Reference Number	Issue	Date
AD-1	MHS TM-TC and Science Data Format Directory	MHS-TN-JA063-MMP	7	January 2004
AD-2	MHS Instrument ICD	MO-IC-MMT-MH-0001	5	July 2001
AD-3	MHS Calibration Algorithm	NOAA Technical Report (unpublished)	Ver. 3	August 2003

Table 1 - Applicable Documents

3 Instrument Modes

The MHS instrument, and its associated interface unit (the MIU) on the NOAA satellites, can operate in a variety of different modes and output several different packets, or formats, of data. The MHS Level 1b format given in this document is applicable for any mode of the MHS instrument and for the "nominal" modes of the MHS Interface Unit (MIU)--i.e., the modes in which the MIU passes through its received MHS data without replacement with its own telemetry data. The MHS Level 1b data will not contain any MIU telemetry. (NOTE: The MIU is a NOAA-specific piece of hardware. There will be no MIU on the Metop satellites. Therefore, references to the MIU, and how it affects the data stream, are only applicable to the MHS data from the NOAA satellites.)

Table 2 shows the nine MHS modes in which packet data is output and the three types of packets that are output in these modes.

MHS Mode	MHS Output
Power-on	Empty Science Data Packet
Warm-up	Empty Science Data Packet
Standby	Empty Science Data Packet
Scan	Science Data Packet
Fixed View	Science Data Packet
Self-test	Extended Test Data Packet
Safeing	Empty Science Data Packet
Fault	Empty Science Data Packet
Memory Dump	Extended Memory Data Packet

Table 2 - MHS Modes and Output

An empty science data packet has the same format as the science data packet. However, except for the initial 39 bytes of housekeeping data, the packet is empty--i.e., zero filled. In fixed view mode, the instrument is not scanning, but is set, or fixed, at one view position. Therefore all of its normal views of earth, space, and the on-board calibration target (OBCT) are of this fixed view position instead. When an empty science data packet is received or when the instrument is in fixed view mode, calibration is unable to be performed. Therefore, scans generated in either of these two situations are marked as unusable.

Technically, memory dump mode is not an actual mode of the MHS. Instead, the MHS can be commanded to perform a memory dump during most of its modes. The extended memory data packet generated during a memory dump supersedes the packet normally output during that particular mode. For the sake of simplicity, this document treats memory dump mode as a unique MHS mode.

4 Data Record Types

According to Table 2, when MHS is in "self-test" mode or "memory dump" mode, it will output an extended test data packet or extended memory dump packet, respectively. In all other modes, including "scan" mode, it will output a (possibly empty) science data packet. The instrument will normally be in "scan" mode. In addition there may be times in which the type of MHS packet can not be determined. For example, the mode code, which identifies the type of packet, in the data stream may be missing. For the NOAA satellites, this is possible if the minor frame containing the mode code is missing. Also, the mode code may be corrupt, and set to one of the "unused" values. In a case in which the packet type can not be determined, it is classified as an "unknown" packet. Each different type of packet output by MHS, and including the "unknown" packet type, results in a different type of data record output to the MHS Level 1b data set. This document provides Level 1b format specifications for all four types of data records. However, no matter the type of data record, they all share the same basic three-part organization: a header section, a packet data section, and a trailer section. The format of the header and trailer sections are identical across the three types of data records. The header section is composed of the first 29 bytes of the data record, which comprise the fields "Scan Line Number" through "Scan Line

Quality Flags [Time Problem Code]", inclusively. The trailer section is composed of the last 238 bytes of the data record, which begins with the field "Main Bus Select Status" and continues through the "<Zero Fill>" padding at end of record. The content and format of the packet data section varies depending on the type of data record. In all cases though, the actual data from the particular MHS packet within this section begins at the same byte offset (1481). Additionally, in the case of data records containing either extended test data packets or extended memory data packets, the packet data is inserted exactly as received from the spacecraft without modification. (Some of the data in a science packet is slightly re-ordered--to align with common fields of the AMSU-B Level 1b data record--with a few additional fields inserted.)

As mentioned in Section 3, an empty science data packet and a science data packet have the same format. The difference is that most of the content of an empty science data packet is, as its name implies, empty. In terms of a Level 1b data record containing an empty science data packet, the following fields are zero filled (empty):

- "Scene (Earth View) Data" (bytes 1481-2560) through "OBCT View Position Validity Flags" (bytes 2686-2686)
- "Status Word" (byte 2727) through "Science Packet Spare Words" (bytes 2789-2833)

However, an empty science data packet does contain valid housekeeping data. So, in a data record containing an empty science data packet, the "Mode and Sub-commutation Code" field (byte 2687) through the "Raw Current Consumption Data" field (bytes 2720-2725) contain valid data.

5 Data Representation and Storage

This section describes the bit and byte numbering conventions used in this document, and the storage methods for integers and floating point numbers. This information is especially critical when transporting data from one computer architecture to another. Without special handling, data produced on one system may be unusable on another due to differences in internal data storage.

5.1 Bit Numbering

A byte in this document is defined as containing 8 bits. A word is 8, 16, or 32 bits in length. In all cases, the least significant bit (lsb) is designated as bit 0 and has a base-10 value of $2^0 = 1$. Therefore, in an 8-bit word the most significant bit (msb) is designated as bit 7, and has a base-10 value of $2^7 = 128$. In a 16-bit word the msb is designated as bit 15, and has a base-10 value of $2^{15} = 32,768$. In a 32-bit word the msb is designated as bit 31, and has a base-10 value of $2^{31} = 2,147,483,648$.

5.2 Signed Integers

For signed binary integers, the msb represents the sign of the number. The remaining bits (bits 6 through 0 for 8-bit words, 14 through 0 for 16-bit words, and 30 through 0 for 32-bit words) are used to designate the magnitude of the number. Therefore, the range of signed binary integers is based on word size as follows:

- 1 byte -128 to 127
- 2 bytes -32,768 to 32,767

- 4 bytes -2,147,483,648 to 2,147,483,647

Positive binary integers are in true binary notation with the sign bit set to zero. Negative binary integers are in two's-complement notation with the sign bit set to one. Negative binary integers are formed in two's-complement notation by inverting each bit of the positive binary integer and adding one.

5.3 Unsigned Integers

Unsigned binary integers use all bits including the msb to represent the magnitude of the number. Therefore, their range is as follows, again, based on word size:

- 1 byte 0 to 255
- 2 bytes 0 to 65,535
- 4 bytes 0 to 4,294,967,295

A field containing a binary integer is given the data type of unsigned integer if its content will never be negative or if a negative value just does not make sense for that field. For example, the idea of a negative scan line number or negative date or time is nonsensical. Therefore, fields containing scan line numbers, dates, and times are labeled as unsigned integers.

Unfortunately, this data type is not supported by all computer languages (e.g., Fortran), so additional data manipulation may be necessary. In the case of reading a 16-bit unsigned integer (DATA), a Fortran user could use the following code snippet to extract the actual value (VALUE):

```
...
INTEGER*2 DATA
INTEGER*4 VALUE
...
READ DATA
IF (DATA .LT. 0) THEN
     VALUE = 65536 + DATA
ELSE
     VALUE = DATA
ENDIF
...
```

But note that nearly all unsigned integer fields can be safely read into signed integer data types of the same word sizes. This is because they were originally written to the 1b using signed integer data types, and thus will be within the positive range of the corresponding signed integer data type (see Section 5.2). The 1b format specifications will clearly indicate, by providing ranges, those unsigned integer fields that must be strictly treated as unsigned integer data types--using the data manipulation described above, if necessary--to ensure that correct values are retrieved.

However, not all fields of an unsigned integer data type contain unsigned binary integers. Fields containing *packed data* are also identified as unsigned integers. While its msb is not a sign bit, a

field containing packed data does not represent an unsigned binary integer. Such a field requires the user to perform some type of special unpacking technique in order to extract the information of interest from the field in order for it to be interpreted correctly. Packed data may be bit fields, packed integers, or both. A bit field is one or more consecutive bits used to indicate one of two or more possible conditions or states. (A *bit flag* is a specialized instance of a bit field. It is a single bit indicating one of only two possible conditions.) For example, a three-bit field may indicate which of seven different modes that an instrument is operating in (i.e., 0 implies "power on mode", 1 implies "warm up mode", 2 implies "standby mode", etc.). A packed integer is simply a binary number that is stored in just a subset of an unsigned integer field's bits. Although similar to a bit field, a packed integer is not an indicator of a condition, but an actual numeric value having magnitude that, once unpacked, could be used in arithmetic computations.

5.4 Scaled Integers

To provide maximum portability of the Level 1b data sets across different computer platforms, floating point data is represented by scaled integers. Scaled integers can be either signed or unsigned, and are simply floating point numbers multiplied by a fixed scaling factor so that a sufficiently precise representation of the original number can be stored in integer form. For example, the floating point value 1.2313 might be multiplied by 10^2 to achieve an integer value of 123. To achieve better precision, the floating point value might be multiplied by 10^3 or 10^4 to achieve an integer value of 1231 or 12313, respectively. In the Level 1b data sets, the scaling factors are powers of ten, and only the exponents (2, 3, and 4 in the previous examples) are documented within the data set. To recover an approximation of the original floating point value, divide the integer value by ten raised to the given exponent.

5.5 Byte Ordering

A major problem impeding the free transport of binary data from one computer system to another is the "Big Endian - Little Endian" dichotomy. *Big Endian* systems (e.g. IBM 370, Macintosh, SGI, Sun SPARC) store bytes of binary numeric data in reverse order relative to *Little Endian* systems (e.g. IBM PC, DEC Alpha). For example, a 32-bit hexadecimal value of x01020304 (decimal value 16,909,060) written to a binary file by a Big Endian system would be read from the file as x04030201 (decimal value 67,305,985) by a Little Endian system. Level 1b data sets generated and archived by NOAA are in Big Endian order; users with Little Endian systems must include an additional byte-swapping step when reading binary numeric data from Level 1b data sets produced by NOAA. Some processors support byte swapping in their instruction sets, but others must use compiler-dependent functions.

6 MHS Level 1b Format Specifications

The format specifications for the MHS Level 1b header record and the three types of MHS Level 1b data records are given in this section. The meaning of each column in the format specifications is defined in Table 3.

Name	Description
Field Name	The name or brief description of the field.
Start Octet	Offset location of first octet in the defined field from beginning of record, starting with octet 1. (Note that the terms "octet" and "byte" are used interchangeably and mean the same thing.)
End Octet	Offset location of last octet in the defined field from beginning of record.
Data Type	Data Type (i - integer, u - unsigned integer, c - character). Character data is stored as ASCII.
Word Size	Number of octets per data word.
Number of Words	Number of words of indicated size and type contained in the defined field.
Scale Factor	Scaling Factor.
Units	The field's unit of measurement (e.g., octets, counts, Kelvin, volts), if applicable.
Notes	References to notes that follow the format specifications in Section 8.

Table 3 - Description of Format Specification Columns

6.1 MHS 1b Primary Header Record Format

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
FILE IDENTIFICATION								
Data Set Creation Site ID CMS=Centre de Meteorologie Spatiale/France DSS=Dundee Satellite Receiving Station/UK NSS=National Environmental Satellite, Data and Information Service/USA UKM=United Kingdom Meteorological Office/UK	1	3	c	3	1	0		
<ASCII blank = x20>	4	4	c	1	1	0		
Level 1b Format Version Number	5	6	u	2	1	0		
Level 1b Format Version Year *(four digits, e.g., 2000)*	7	8	u	2	1	0		
Level 1b Format Version Day of Year *(e.g., 365)*	9	10	u	2	1	0		
<Reserved for Logical Record Length> *(For Creation Site use only. Logical Record Length of source 1b data set prior to processing.)*	11	12	u	2	1	0	octets	
<Reserved for Block Size> *(For Creation Site use only. Block Size of source 1b data set prior to processing.)*	13	14	u	2	1	0	octets	
Count of Header Records in this Data Set	15	16	u	2	1	0		
<Zero Fill>	17	22	i	2	3	0		
Data Set Name	23	64	c	42	1	0		
Processing Block Identification	65	72	c	8	1	0		
Spacecraft Identification Code 7=NOAA-N 8=NOAA-N' 1=Metop-1 (TBC) 2=Metop-2 (TBC)	73	74	u	2	1	0		
Instrument ID 0=proto-flight model (PFM) (NOAA-N) 2=FM2 (NOAA-N') 3=FM3 (Metop-2) 4=FM4 (Metop-1) 5=FM5 (Metop-3)	75	76	u	2	1	0		
Data Type Code 12=MHS	77	78	u	2	1	0		
TIP Source Code *(NOAA: values defined below)* or <Zero Fill> *(Metop)* 0=unused, i.e., GAC/HRPT/LAC data 1=GAC-embedded AMSU and TIP 2=stored TIP (STIP) 3=HRPT/LAC-embedded AMSU and TIP 4=stored AIP (SAIP)	79	80	u	2	1	0		
Start of Data Set Day Count starting from 0 at 00h, 1 Jan 1950	81	84	u	4	1	0		
Start of Data Set Year *(four digits, e.g., 2000)*	85	86	u	2	1	0		
Start of Data Set Day of Year *(e.g., 365)*	87	88	u	2	1	0		
Start of Data Set UTC Time of Day	89	92	u	4	1	0	milliseconds	
End of Data Set Day Count starting from 0 at 00h, 1 Jan 1950	93	96	u	4	1	0		
End of Data Set Year *(four digits, e.g., 2000)*	97	98	u	2	1	0		
End of Data Set Day of Year *(e.g., 365)*	99	100	u	2	1	0		
End of Data Set UTC Time of Day	101	104	u	4	1	0	milliseconds	
Year of Last CPIDS Update *(four digits, e.g., 2000)*	105	106	u	2	1	0		
Day of Year of Last CPIDS Update *(e.g., 365)*	107	108	u	2	1	0		
Offset between Start of Scan and Center of First FOV	109	110	i	2	1	0	milliseconds	
<Zero Fill>	111	120	i	2	5	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
DATA SET QUALITY INDICATORS								
Instrument Status *(These are bit flags taken from "Mode and Sub-commutation Code" field and "Switch Status" field on first data record for which all of the individual status flags have been reported at least once.)* bits 31-28: mode code (0=power on; 1=warm up; 2=stand by; 3=scan; 4=fixed view; 5=self test; 6=safeing; 7=fault; 8-14=<unused>; 15=memory data packet ID) bit 27: PIE ID (0=PIE A; 1=PIE B) bits 26-24: sub-commutation code (only meaningful for telemetry packet data) bit 23: receiver channel H4 backend (0=off; 1=on) bit 22: receiver channel H3 backend (0=off; 1=on) bit 21: receiver channel H3/H4 local oscillator selected (0=A; 1=B) bit 20: receiver channel H3/H4 front-end (0=off; 1=on) bit 19: receiver channel H2 local oscillator selected (0=A; 1=B) bit 18: receiver channel H2 (0=off; 1=on) bit 17: receiver channel H1 local oscillator selected (0=A; 1=B) bit 16: receiver channel H1 (0=off; 1=on) bit 15: PROM (1=a PROM segment switch has failed ON) bit 14: signal processing electronics/scan control electronics (0=off; 1=on) bit 13: auxiliary operational heaters (0=off; 1=on) bit 12: scan mechanism operational heaters (0=off; 1=on) bit 11: receiver operational heaters (0=off; 1=on) bit 10: Rx CV (0=off; 1=on) bit 9: receiver channel H5 local oscillator selected (0=A; 1=B) bit 8: receiver channel H5 (0=off; 1=on) bit 7: FDM motor current trip status (0=enabled; 1=disabled) bit 6: RDM motor current trip status (0=enabled; 1=disabled) bit 5: FDM motor supply (0=off; 1=on) bit 4: RDM motor supply (0=off; 1=on) bit 3: FDM motor sensors selected (0=A; 1=B) bit 2: RDM motor sensors selected (0=A; 1=B) bit 1: FDM zero position sensors (0=A; 1=B) bit 0: RDM zero position sensors (0=A; 1=B)	121	124	u	4	1	0		
<Zero Fill>	125	126	i	2	1	0		
Record Number of Status Change *(if 0, none occurred)*	127	128	u	2	1	0		
Second Instrument Status *(if previous word is 0, no change)*	129	132	u	4	1	0		
Count of Data Records in this Data Set	133	134	u	2	1	0		
Count of Calibrated, Earth Located Scan Lines in this Data Set	135	136	u	2	1	0		
Count of Missing Scan Lines	137	138	u	2	1	0		
Count of Data Gaps in this Data Set *(NOTE: Gaps are due to either actual lost data, such as during transmissions, or ignored data when the instrument science data is superceded by other telemetry data during non-nominal modes of the TIP or MIU.)*	139	140	u	2	1	0		
Count of Scans Containing Lunar-Contaminated Space Views *(Also, see bits 1 and 0 of Word 1 of "Scan Line Quality Flags [Calibration Problem Code]" field in data record.)* -1=the detection algorithm for lunar contamination is turned off 0=the detection algorithm is turned on: no scans containing lunar-contaminated space views were found >0=the detection algorithm is turned on: the value in this field represents the number of scans found that contain lunar-contaminated space views	141	142	i	2	1	0		
Count of Data Frames Without Frame Sync Word Errors *(NOAA)* or <Zero Fill> *(Metop)*	143	144	u	2	1	0		
Count of PACS Detected TIP Parity Errors *(NOAA)* or <Zero Fill> *(Metop)*	145	146	u	2	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Sum of All Auxiliary Sync Errors Detected in the Input Data *(NOAA)* or <Zero Fill> *(Metop)*	147	148	u	2	1	0		
Time Sequence Error 0=none; otherwise, the record number of the first occurrence	149	150	u	2	1	0		
Time Sequence Error Code *(These are bit flags taken from "Scan Line Quality Flags [Time Problem Code]" on data record reported in "Time Sequence Error" field above. If a bit is on (=1) then the statement is true.)* bits 15-8: <zero fill> bit 7: time field is bad but can probably be inferred from the previous good time bit 6: time field is bad and can't be inferred from the previous good time bit 5: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity); may be associated with a spacecraft clock update bit 4: start of a sequence that apparently repeats scan times that have been previously accepted bits 3-0: <zero fill>	151	152	u	2	1	0		
SOCC Clock Update Indicator 0=none during this orbit; otherwise, the record number of the first occurrence	153	154	u	2	1	0		
Earth Location Error Indicator 0=none during this orbit; otherwise, the record number of the first occurrence	155	156	u	2	1	0		
Earth Location Error Code *(These are bit flags taken from "Scan Line Quality Flags [Earth Location Problem Code]" on data record reported in "Earth Location Error Indicator" field above. If a bit is on (=1) then the statement is true.)* bits 15-8: <zero fill> bit 7: not earth located because of bad time; earth location fields zero-filled bit 6: earth location questionable: questionable time code bit 5: earth location questionable: marginal agreement with reasonableness check bit 4: earth location questionable: fails reasonableness check bit 3: earth location questionable because of antenna position check bit 2: <zero fill> bit 1: not earth located because of satellite in-plane maneuver (Metop) or <zero fill> (NOAA) bit 0: not earth located because of satellite out-of-plane maneuver (Metop) or <zero fill> (NOAA)	157	158	u	2	1	0		
PACS Status Bit Field *(NOAA: value defined below)* or <Zero Fill> *(Metop)* bits 15-3: <zero fill> bit 2: pseudonoise (0=normal data; 1=pseudonoise data) bit 1: tape direction (0=reverse playback, time decrementing) bit 0: data mode (0=test data; 1=flight data)	159	160	u	2	1	0		
Data Source 0=unused 1=Fairbanks, AK 2=Wallops Is., VA 3=SOCC 4=Svalbard, Norway 5=Monterey, CA	161	162	u	2	1	0		
<Reserved for the Ingester>	163	170	c	8	1	0		
<Reserved for Decommutation>	171	178	c	8	1	0		
<Zero Fill>	179	194	i	2	8	0		
CALIBRATION								
Instrument Temperature Sensor ID 0=primary (H5 LO temperature [QBS5]) 1=backup (H1 LO temperature [QBS1])	195	196	i	2	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
<Zero Fill>	197	198	i	2	1	0		
Primary Reference Temperature (from QBS5), Minimum	199	200	i	2	1	2	K	
Primary Reference Temperature (from QBS5), Nominal	201	202	i	2	1	2	K	
Primary Reference Temperature (from QBS5), Maximum	203	204	i	2	1	2	K	
Backup Reference Temperature (from QBS1), Minimum	205	206	i	2	1	2	K	
Backup Reference Temperature (from QBS1), Nominal	207	208	i	2	1	2	K	
Backup Reference Temperature (from QBS1), Maximum	209	210	i	2	1	2	K	
Ch. H1 Warm Load Correction Factor (minimum temperature)	211	212	i	2	1	3	K	
Ch. H1 Warm Load Correction Factor (nominal temperature)	213	214	i	2	1	3	K	
Ch. H1 Warm Load Correction Factor (maximum temperature)	215	216	i	2	1	3	K	
Ch. H1 Cold Space Temperature Correction (profile 0)	217	218	i	2	1	3	K	
Ch. H1 Cold Space Temperature Correction (profile 1)	219	220	i	2	1	3	K	
Ch. H1 Cold Space Temperature Correction (profile 2)	221	222	i	2	1	3	K	
<Reserved for Profile 3>	223	224	i	2	1	0		
Ch. H2 Warm Load Correction Factor (minimum temperature)	225	226	i	2	1	3	K	
Ch. H2 Warm Load Correction Factor (nominal temperature)	227	228	i	2	1	3	K	
Ch. H2 Warm Load Correction Factor (maximum temperature)	229	230	i	2	1	3	K	
Ch. H2 Cold Space Temperature Correction (profile 0)	231	232	i	2	1	3	K	
Ch. H2 Cold Space Temperature Correction (profile 1)	233	234	i	2	1	3	K	
Ch. H2 Cold Space Temperature Correction (profile 2)	235	236	i	2	1	3	K	
<Reserved for Profile 3>	237	238	i	2	1	0		
Ch. H3 Warm Load Correction Factor (minimum temperature)	239	240	i	2	1	3	K	
Ch. H3 Warm Load Correction Factor (nominal temperature)	241	242	i	2	1	3	K	
Ch. H3 Warm Load Correction Factor (maximum temperature)	243	244	i	2	1	3	K	
Ch. H3 Cold Space Temperature Correction (profile 0)	245	246	i	2	1	3	K	
Ch. H3 Cold Space Temperature Correction (profile 1)	247	248	i	2	1	3	K	
Ch. H3 Cold Space Temperature Correction (profile 2)	249	250	i	2	1	3	K	
<Reserved for Profile 3>	251	252	i	2	1	0		
Ch. H4 Warm Load Correction Factor (minimum temperature)	253	254	i	2	1	3	K	
Ch. H4 Warm Load Correction Factor (nominal temperature)	255	256	i	2	1	3	K	
Ch. H4 Warm Load Correction Factor (maximum temperature)	257	258	i	2	1	3	K	
Ch. H4 Cold Space Temperature Correction (profile 0)	259	260	i	2	1	3	K	
Ch. H4 Cold Space Temperature Correction (profile 1)	261	262	i	2	1	3	K	
Ch. H4 Cold Space Temperature Correction (profile 2)	263	264	i	2	1	3	K	
<Reserved for Profile 3>	265	266	i	2	1	0		
Ch. H5 Warm Load Correction Factor (minimum temperature)	267	268	i	2	1	3	K	
Ch. H5 Warm Load Correction Factor (nominal temperature)	269	270	i	2	1	3	K	
Ch. H5 Warm Load Correction Factor (maximum temperature)	271	272	i	2	1	3	K	
Ch. H5 Cold Space Temperature Correction (profile 0)	273	274	i	2	1	3	K	
Ch. H5 Cold Space Temperature Correction (profile 1)	275	276	i	2	1	3	K	
Ch. H5 Cold Space Temperature Correction (profile 2)	277	278	i	2	1	3	K	
<Reserved for Profile 3>	279	280	i	2	1	0		
LO A Ch. H1 Nonlinearity Coefficient (minimum temperature)	281	284	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO A Ch. H1 Nonlinearity Coefficient (nominal temperature)	285	288	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO A Ch. H1 Nonlinearity Coefficient (maximum temperature)	289	292	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO A Ch. H2 Nonlinearity Coefficient (minimum temperature)	293	296	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO A Ch. H2 Nonlinearity Coefficient (nominal temperature)	297	300	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO A Ch. H2 Nonlinearity Coefficient (maximum temperature)	301	304	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO A Ch. H3 Nonlinearity Coefficient (minimum temperature)	305	308	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO A Ch. H3 Nonlinearity Coefficient (nominal temperature)	309	312	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO A Ch. H3 Nonlinearity Coefficient (maximum temperature)	313	316	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO A Ch. H4 Nonlinearity Coefficient (minimum temperature)	317	320	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO A Ch. H4 Nonlinearity Coefficient (nominal temperature)	321	324	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO A Ch. H4 Nonlinearity Coefficient (maximum temperature)	325	328	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO A Ch. H5 Nonlinearity Coefficient (minimum temperature)	329	332	i	4	1	8	m^2-sr-cm^{-1}/mW	

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
LO A Ch. H5 Nonlinearity Coefficient (nominal temperature)	333	336	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO A Ch. H5 Nonlinearity Coefficient (maximum temperature)	337	340	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO B Ch. H1 Nonlinearity Coefficient (minimum temperature)	341	344	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO B Ch. H1 Nonlinearity Coefficient (nominal temperature)	345	348	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO B Ch. H1 Nonlinearity Coefficient (maximum temperature)	349	352	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO B Ch. H2 Nonlinearity Coefficient (minimum temperature)	353	356	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO B Ch. H2 Nonlinearity Coefficient (nominal temperature)	357	360	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO B Ch. H2 Nonlinearity Coefficient (maximum temperature)	361	364	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO B Ch. H3 Nonlinearity Coefficient (minimum temperature)	365	368	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO B Ch. H3 Nonlinearity Coefficient (nominal temperature)	369	372	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO B Ch. H3 Nonlinearity Coefficient (maximum temperature)	373	376	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO B Ch. H4 Nonlinearity Coefficient (minimum temperature)	377	380	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO B Ch. H4 Nonlinearity Coefficient (nominal temperature)	381	384	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO B Ch. H4 Nonlinearity Coefficient (maximum temperature)	385	388	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO B Ch. H5 Nonlinearity Coefficient (minimum temperature)	389	392	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO B Ch. H5 Nonlinearity Coefficient (nominal temperature)	393	396	i	4	1	8	m^2-sr-cm^{-1}/mW	
LO B Ch. H5 Nonlinearity Coefficient (maximum temperature)	397	400	i	4	1	8	m^2-sr-cm^{-1}/mW	
<Zero Fill>	401	416	i	4	4	0		
TEMPERATURE-RADIANCE CONVERSION								
Temperature-radiance Ch H1 Central Wavenumber	417	420	i	4	1	6	cm^{-1}	
Temperature-radiance Ch H1 Constant 1	421	424	i	4	1	6		
Temperature-radiance Ch H1 Constant 2	425	428	i	4	1	6		
Temperature-radiance Ch H2 Central Wavenumber	429	432	i	4	1	6	cm^{-1}	
Temperature-radiance Ch H2 Constant 1	433	436	i	4	1	6		
Temperature-radiance Ch H2 Constant 2	437	440	i	4	1	6		
Temperature-radiance Ch H3 Central Wavenumber	441	444	i	4	1	6	cm^{-1}	
Temperature-radiance Ch H3 Constant 1	445	448	i	4	1	6		
Temperature-radiance Ch H3 Constant 2	449	452	i	4	1	6		
Temperature-radiance Ch H4 Central Wavenumber	453	456	i	4	1	6	cm^{-1}	
Temperature-radiance Ch H4 Constant 1	457	460	i	4	1	6		
Temperature-radiance Ch H4 Constant 2	461	464	i	4	1	6		
Temperature-radiance Ch H5 Central Wavenumber	465	468	i	4	1	6	cm^{-1}	
Temperature-radiance Ch H5 Constant 1	469	472	i	4	1	6		
Temperature-radiance Ch H5 Constant 2	473	476	i	4	1	6		
<Zero Fill>	477	492	i	4	4	0		
NAVIGATION								
Reference Ellipsoid Model ID *(The ellipsoid is a mathematically tractable approximation of the geoid, which is an equipotential surface at mean sea level. The maximum departure of the ellipsoid from the geoid is approximately +/- 65 meters.)* WGS-72=World Geodetic Survey 1972	493	500	c	8	1	0		
Nadir Earth Location Tolerance	501	502	u	2	1	1	kilometers	
Earth Location Bit Field bits 15-3: <zero fill> bit 2: dynamic attitude error correction (0=not performed; 1=performed) bit 1: reasonableness test (0=inactive; 1=active) bit 0: constant attitude error correction (0=not performed; 1=performed)	503	504	u	2	1	0		
<Zero Fill>	505	506	i	2	1	0		
Constant Roll Attitude Error	507	508	i	2	1	3	degrees	
Constant Pitch Attitude Error	509	510	i	2	1	3	degrees	
Constant Yaw Attitude Error	511	512	i	2	1	3	degrees	
Epoch Year for Orbit Vector	513	514	u	2	1	0		
Day of Epoch Year for Orbit Vector	515	516	u	2	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Epoch UTC Time of Day for Orbit Vector	517	520	u	4	1	0	milliseconds	
Semi-major Axis *(at the orbit vector epoch time)*	521	524	i	4	1	5	kilometers	
Eccentricity *(at the orbit vector epoch time)*	525	528	i	4	1	8		
Inclination *(at the orbit vector epoch time)*	529	532	i	4	1	5	degrees	
Argument of Perigee *(at the orbit vector epoch time)*	533	536	i	4	1	5	degrees	
Right Ascension of the Ascending Node *(at the orbit vector epoch time)*	537	540	i	4	1	5	degrees	
Mean Anomaly *(at the orbit vector epoch time)*	541	544	i	4	1	5	degrees	
Position Vector X Component *(at the orbit vector epoch time)*	545	548	i	4	1	5	kilometers	
Position Vector Y Component *(at the orbit vector epoch time)*	549	552	i	4	1	5	kilometers	
Position Vector Z Component *(at the orbit vector epoch time)*	553	556	i	4	1	5	kilometers	
Velocity Vector X-dot Component *(at the orbit vector epoch time)*	557	560	i	4	1	8	km/second	
Velocity Vector Y-dot Component *(at the orbit vector epoch time)*	561	564	i	4	1	8	km/second	
Velocity Vector Z-dot Component *(at the orbit vector epoch time)*	565	568	i	4	1	8	km/second	
Earth/Sun Distance Ratio *(at the orbit vector epoch time; relative to the mean distance of 1 AU)*	569	572	u	4	1	6		
<Zero Fill>	573	588	i	4	4	0		
THERMISTOR TELEMETRY CONVERSION *Counts-to-temperature (K) conversion coefficients for the 24 housekeeping thermistors.*								
Thermistor Temperature Coefficient 0	589	592	i	4	1	4	K	
Thermistor Temperature Coefficient 1	593	596	i	4	1	7	K/count	
Thermistor Temperature Coefficient 2	597	600	i	4	1	10	$K/count^2$	
Thermistor Temperature Coefficient 3	601	604	i	4	1	12	$K/count^3$	
Thermistor Temperature Coefficient 4	605	608	i	4	1	15	$K/count^4$	
<Zero Fill>	609	624	i	4	4	0		
RAW CURRENT CONSUMPTION CONVERSION								
EE and SM +5V Current Coefficient 0	625	628	i	4	1	6	amps	
EE and SM +5V Current Coefficient 1	629	632	i	4	1	6	amps/count	
Receiver +8V Current Coefficient 0	633	636	i	4	1	6	amps	
Receiver +8V Current Coefficient 1	637	640	i	4	1	6	amps/count	
Receiver +15V Current Coefficient 0	641	644	i	4	1	6	amps	
Receiver +15V Current Coefficient 1	645	648	i	4	1	6	amps/count	
Receiver -15V Current Coefficient 0	649	652	i	4	1	6	amps	
Receiver -15V Current Coefficient 1	653	656	i	4	1	6	amps/count	
RDM Motor Current Coefficient 0	657	660	i	4	1	6	amps	
RDM Motor Current Coefficient 1	661	664	i	4	1	6	amps/count	
FDM Motor Current Coefficient 0	665	668	i	4	1	6	amps	
FDM Motor Current Coefficient 1	669	672	i	4	1	6	amps/count	
OBCT TEMPERATURE CONVERSION *PRT resistance-to-temperature conversion coefficients, where resistance is in ohms and temperature is in K.*								
PIE-A PRT 1 Coefficient 0	673	676	i	4	1	6	K	
PIE-A PRT 1 Coefficient 1	677	680	i	4	1	6	K/ohm	
PIE-A PRT 1 Coefficient 2	681	684	i	4	1	10	K/ohm^2	
PIE-A PRT 1 Coefficient 3	685	688	i	4	1	13	K/ohm^3	
PIE-A PRT 2 Coefficient 0	689	692	i	4	1	6	K	
PIE-A PRT 2 Coefficient 1	693	696	i	4	1	6	K/ohm	
PIE-A PRT 2 Coefficient 2	697	700	i	4	1	10	K/ohm^2	
PIE-A PRT 2 Coefficient 3	701	704	i	4	1	13	K/ohm^3	
PIE-A PRT 3 Coefficient 0	705	708	i	4	1	6	K	
PIE-A PRT 3 Coefficient 1	709	712	i	4	1	6	K/ohm	

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
PIE-A PRT 3 Coefficient 2	713	716	i	4	1	10	K/ohm^2	
PIE-A PRT 3 Coefficient 3	717	720	i	4	1	13	K/ohm^3	
PIE-A PRT 4 Coefficient 0	721	724	i	4	1	6	K	
PIE-A PRT 4 Coefficient 1	725	728	i	4	1	6	K/ohm	
PIE-A PRT 4 Coefficient 2	729	732	i	4	1	10	K/ohm^2	
PIE-A PRT 4 Coefficient 3	733	736	i	4	1	13	K/ohm^3	
PIE-A PRT 5 Coefficient 0	737	740	i	4	1	6	K	
PIE-A PRT 5 Coefficient 1	741	744	i	4	1	6	K/ohm	
PIE-A PRT 5 Coefficient 2	745	748	i	4	1	10	K/ohm^2	
PIE-A PRT 5 Coefficient 3	749	752	i	4	1	13	K/ohm^3	
PIE-B PRT 1 Coefficient 0	753	756	i	4	1	6	K	
PIE-B PRT 1 Coefficient 1	757	760	i	4	1	6	K/ohm	
PIE-B PRT 1 Coefficient 2	761	764	i	4	1	10	K/ohm^2	
PIE-B PRT 1 Coefficient 3	765	768	i	4	1	13	K/ohm^3	
PIE-B PRT 2 Coefficient 0	769	772	i	4	1	6	K	
PIE-B PRT 2 Coefficient 1	773	776	i	4	1	6	K/ohm	
PIE-B PRT 2 Coefficient 2	777	780	i	4	1	10	K/ohm^2	
PIE-B PRT 2 Coefficient 3	781	784	i	4	1	13	K/ohm^3	
PIE-B PRT 3 Coefficient 0	785	788	i	4	1	6	K	
PIE-B PRT 3 Coefficient 1	789	792	i	4	1	6	K/ohm	
PIE-B PRT 3 Coefficient 2	793	796	i	4	1	10	K/ohm^2	
PIE-B PRT 3 Coefficient 3	797	800	i	4	1	13	K/ohm^3	
PIE-B PRT 4 Coefficient 0	801	804	i	4	1	6	K	
PIE-B PRT 4 Coefficient 1	805	808	i	4	1	6	K/ohm	
PIE-B PRT 4 Coefficient 2	809	812	i	4	1	10	K/ohm^2	
PIE-B PRT 4 Coefficient 3	813	816	i	4	1	13	K/ohm^3	
PIE-B PRT 5 Coefficient 0	817	820	i	4	1	6	K	
PIE-B PRT 5 Coefficient 1	821	824	i	4	1	6	K/ohm	
PIE-B PRT 5 Coefficient 2	825	828	i	4	1	10	K/ohm^2	
PIE-B PRT 5 Coefficient 3	829	832	i	4	1	13	K/ohm^3	
SURVIVAL TEMPERATURE CONVERSION *Volts-to-temperature (K) conversion coefficients for the 3 survival temperature parameters. (NOTE: volts = 0.02 * counts.)*								
Survival Temperature Coefficient 0	833	836	i	4	1	6	K	
Survival Temperature Coefficient 1	837	840	i	4	1	6	K/volt	
Survival Temperature Coefficient 2	841	844	i	4	1	6	$K/volt^2$	
Survival Temperature Coefficient 3	845	848	i	4	1	6	$K/volt^3$	
Survival Temperature Coefficient 4	849	852	i	4	1	6	$K/volt^4$	
Survival Temperature Coefficient 5	853	856	i	4	1	6	$K/volt^5$	
ANTENNA POSITION CONVERSION								
Antenna Position Conversion Factor *(for converting "mid-pixel position" data of earth, space, and OBCT views to degrees)* value = 7.2/1024 = 0.00703125 degrees/count	857	860	u	4	1	8	degrees/count	
PRT CALIBRATION CHANNELS								
PIE-A Calibration Channel 1 Resistance	861	864	i	4	1	4	ohms	
PIE-A Calibration Channel 2 Resistance	865	868	i	4	1	4	ohms	
PIE-A Calibration Channel 3 Resistance	869	872	i	4	1	4	ohms	
PIE-B Calibration Channel 1 Resistance	873	876	i	4	1	4	ohms	
PIE-B Calibration Channel 2 Resistance	877	880	i	4	1	4	ohms	
PIE-B Calibration Channel 3 Resistance	881	884	i	4	1	4	ohms	

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
LUNAR CONTAMINATION DETECTION								
Lunar Angle Threshold *(Any space view whose lunar angle--see "Lunar Angles" field in data record--is less than this value is flagged as being "lunar contaminated" and is not used in the calibration.)*	885	886	u	2	1	2	degrees	
RFI CORRECTION								
Bias Correction Values *(ordered by channel, FOV, and transmitter) (NOAA: content defined below)* or TBD *(Metop)* Word 1: Channel H1, FOV 1, STX_1 Word 2: Channel H2, FOV 1, STX_1 Word 3: Channel H3, FOV 1, STX_1 Word 4: Channel H4, FOV 1, STX_1 Word 5: Channel H5, FOV 1, STX_1 Word 6: Channel H1, FOV 5, STX_1 ... (channel values for FOVs 5, 10, 15, ... , 90) ... Word 95: Channel H5, FOV 90, STX_1 Word 96: Channel H1, space view, STX_1 ... Word 100: Channel H5, space view, STX_1 Word 101: Channel H1, OBCT view, STX_1 ... Word 106: Channel H1, FOV 1, STX_2 ... Word 211: Channel H1, FOV 1, STX_3 ... Word 316: Channel H1, FOV 1, SARR ... Word 420: Channel H5, OBCT view, SARR	887	1726	i	2	420	0	counts	2
<Zero Fill>	1727	1734	i	2	4	0		
Transmitter Reference Power *(mean power at the time bias corrections were derived. Range: 0 to 255, representing analog voltages from 0 to 5.1.) (NOAA: content defined below)* or TBD *(Metop)* Word 1: STX-1 Word 2: STX-2 Word 3: STX-3 Word 4: SARR	1735	1742	i	2	4	1	counts	2
<Zero Fill>	1743	1752	i	2	5	0		
METOP MANEUVERS IDENTIFICATION *The fields in this section are Metop specific. For NOAA-originated MHS data, these fields are spare (zero fill).*								
Start of Maneuver Year *(four digits, e.g., 2000)*	1753	1754	u	2	1	0		
Start of Maneuver Day of Year *(e.g., 365)*	1755	1756	u	2	1	0		
Start of Maneuver UTC Time of Day	1757	1760	u	4	1	0	milliseconds	
End of Maneuver Year *(four digits, e.g., 2000)*	1761	1762	u	2	1	0		
End of Maneuver Day of Year *(e.g., 365)*	1763	1764	u	2	1	0		
End of Maneuver UTC Time of Day	1765	1768	u	4	1	0	milliseconds	
Change in Spacecraft Velocity (ΔV) Word 1: TBD Word 2: TBD Word 3: TBD	1769	1780	i	4	3	TBD	TBD	
Spacecraft Mass Word 1: Mass before maneuver Word 2: Mass after maneuver	1781	1788	u	4	2	TBD	TBD	
FILLER								
<Zero Fill>	1789	3072	i	2	642	0		

6.2 MHS 1b Data Record Format (Science Packet)

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
SCAN LINE INFORMATION								
Scan Line Number *(cumulative, starting with 1)*	1	2	u	2	1	0		
Scan Line Year *(four digits, e.g., 2000)*	3	4	u	2	1	0		
Scan Line Day of Year *(e.g., 365)*	5	6	u	2	1	0		
Satellite Clock Drift Delta	7	8	i	2	1	0	milliseconds	
Scan Line UTC Time of Day	9	12	u	4	1	0	milliseconds	
Scan Line Bit Field bit 15: satellite direction (0=northbound; 1=southbound) bit 14: clock drift correction (0=not corrected; 1=scan time corrected for clock drift) bits 13-0: <zero fill>	13	14	u	2	1	0		
Major Frame Count *(cumulative, starting with 1) (NOAA)* or <Zero Fill> *(Metop)*	15	16	u	2	1	0		
Coarse MHS On-board Time (OBT) *(time since last reset to zero)*	17	20	u	4	1	0	seconds	
Fine MHS OBT *(fraction of second since last increment of coarse MHS OBT. Resolution: 2^{-16} seconds; range: 0 - 65,535.)*	21	22	u	2	1	0		
MHS Mode Flag 0=power-on ("empty" MHS science data) 1=warm-up ("empty" MHS science data) 2=standby ("empty" MHS science data) 3=scan (valid MHS science data) 4=fixed view (valid MHS science data, but instrument is viewing a fixed location) 5=self-test (test data) 6=safeing ("empty" MHS science data) 7=fault ("empty" MHS science data) 8-14=<undefined> (unknown data) 15=memory dump (memory dump data)	23	23	u	1	1	0		
<Zero Fill>	24	24	i	1	1	0		
QUALITY INDICATORS								
Quality Indicator Bit Field *(if a bit is on (=1), the statement is true)* bit 31: do not use scan for product generation bit 30: time sequence error detected within this scan (see below) bit 29: data gap precedes this scan (gap may be due to actual lost scans or scans in which the TIP or MIU are in non-nominal modes) bit 28: insufficient data for calibration (see below) bit 27: earth location data not available (see below) bit 26: first good time following a clock update (nominally 0) bit 25: instrument status changed with this scan bits 24 - 5: <zero fill> bit 4: transmitter status change occurred (see note 2) bit 3: AMSU sync error detected (NOAA) or <zero fill> (Metop) bit 2: AMSU minor frame error detected (NOAA) or <zero fill> (Metop) bit 1: AMSU major frame error detected (NOAA) or <zero fill> (Metop) bit 0: AMSU parity error detected (NOAA) or <zero fill> (Metop)	25	28	u	4	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Scan Line Quality Flags [Time Problem Code] *(If a bit is on (=1), the statement is true. All bits off implies the scan time is as expected.)* bit 7: time field is bad but can probably be inferred from the previous good time bit 6: time field is bad and can't be inferred from the previous good time bit 5: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may be associated with a spacecraft clock update. (See bit 26, Quality Indicator Bit Field.) bit 4: start of a sequence that apparently repeats scan times that have been previously accepted bits 3-0: <zero fill>	29	29	u	1	1	0		
QUALITY INDICATORS								
Scan Line Quality Flags [Calibration Problem Code] *(If a bit is on (=1), the statement is true. These bits complement the channel indicators; all bits set to 0 indicates normal calibration.)* *Word 1* bits 7-3: <zero fill> bit 2: scan line was not calibrated because of satellite maneuver (Metop) or <zero fill> (NOAA) bit 1: scan line contains one or more space views that are lunar contaminated bit 0: lunar-contaminated scan line was able to be calibrated (only applicable if the previous flag [bit 9] is 1; otherwise, zero) *Word 2* bit 7: scan line was not calibrated because of bad time bit 6: scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap bit 5: scan line was not calibrated because of bad or insufficient PRT data bit 4: scan line was calibrated but with marginal PRT data bit 3: some uncalibrated channels on this scan (see channel indicators) bit 2: uncalibrated due to instrument mode bit 1: questionable calibration because of antenna position error of space view bit 0: questionable calibration because of antenna position error of OBCT view	30	31	u	1	2	0		
Scan Line Quality Flags [Earth Location Problem Code] *(If a bit is on (=1), the statement is true. All bits set to 0 implies the earth location was normal.)* bit 7: not earth located because of bad time; earth location fields zero-filled bit 6: earth location questionable: questionable time code (see time problem flags above) bit 5: earth location questionable: marginal agreement with reasonableness check bit 4: earth location questionable: fails reasonableness check bit 3: earth location questionable because of antenna position check bit 2: <zero fill> bit 1: not earth located because of satellite in-plane maneuver (Metop) or <zero fill> (NOAA) bit 0: not earth located because of satellite out-of-plane maneuver (Metop) or <zero fill> (NOAA)	32	32	u	1	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Calibration Quality Flags *(all bits off implies a good calibration)* *Word 1: Channel H1* bits 15-7: <zero fill> bit 6: this scan line is either the last one before or the first one after a sudden, anomalous jump (or drop) in calibration counts bit 5: all bad OBCT view counts for scan line bit 4: all bad space view counts for scan line bit 3: all bad PRTs for this line bit 2: marginal OBCT view counts for this line bit 1: marginal space view counts for this line bit 0: marginal PRT temps on this line *Words 2-5: Channels H2-H5 (in order)*	33	42	u	2	5	0		
<Zero Fill>	43	60	i	2	9	0		
CALIBRATION COEFFICIENTS *Note: The following coefficients are only available in Scan and Fixed View modes, otherwise the coefficient fields are <Zero Fill>. Refer to bits 7-4 of the Mode and Sub-commutation Code field for the current mode.*								
Primary Calibration Ch H1 Second Order Term, a2	61	64	i	4	1	16		
Primary Calibration Ch H1 First Order Term, a1	65	68	i	4	1	10		
Primary Calibration Ch H1 Zeroth Order Term, a0	69	72	i	4	1	6		
Primary Calibration Ch H2 Second Order Term, a2	73	76	i	4	1	16		
Primary Calibration Ch H2 First Order Term, a1	77	80	i	4	1	10		
Primary Calibration Ch H2 Zeroth Order Term, a0	81	84	i	4	1	6		
Primary Calibration Ch H3 Second Order Term, a2	85	88	i	4	1	16		
Primary Calibration Ch H3 First Order Term, a1	89	92	i	4	1	10		
Primary Calibration Ch H3 Zeroth Order Term, a0	93	96	i	4	1	6		
Primary Calibration Ch H4 Second Order Term, a2	97	100	i	4	1	16		
Primary Calibration Ch H4 First Order Term, a1	101	104	i	4	1	10		
Primary Calibration Ch H4 Zeroth Order Term, a0	105	108	i	4	1	6		
Primary Calibration Ch H5 Second Order Term, a2	109	112	i	4	1	16		
Primary Calibration Ch H5 First Order Term, a1	113	116	i	4	1	10		
Primary Calibration Ch H5 Zeroth Order Term, a0	117	120	i	4	1	6		
Secondary Calibration Ch H1 Second Order Term, a2	121	124	i	4	1	16		
Secondary Calibration Ch H1 First Order Term, a1	125	128	i	4	1	10		
Secondary Calibration Ch H1 Zeroth Order Term, a0	129	132	i	4	1	6		
Secondary Calibration Ch H2 Second Order Term, a2	133	136	i	4	1	16		
Secondary Calibration Ch H2 First Order Term, a1	137	140	i	4	1	10		
Secondary Calibration Ch H2 Zeroth Order Term, a0	141	144	i	4	1	6		
Secondary Calibration Ch H3 Second Order Term, a2	145	148	i	4	1	16		
Secondary Calibration Ch H3 First Order Term, a1	149	152	i	4	1	10		
Secondary Calibration Ch H3 Zeroth Order Term, a0	153	156	i	4	1	6		
Secondary Calibration Ch H4 Second Order Term, a2	157	160	i	4	1	16		
Secondary Calibration Ch H4 First Order Term, a1	161	164	i	4	1	10		
Secondary Calibration Ch H4 Zeroth Order Term, a0	165	168	i	4	1	6		
Secondary Calibration Ch H5 Second Order Term, a2	169	172	i	4	1	16		
Secondary Calibration Ch H5 First Order Term, a1	173	176	i	4	1	10		
Secondary Calibration Ch H5 Zeroth Order Term, a0	177	180	i	4	1	6		
<Zero Fill>	181	184	i	2	2	0		
NAVIGATION								
Computed Yaw Steering *(Metop: content defined below)* or <Zero Fill> *(NOAA)* Word 1: Computed roll angle Word 2: Computed pitch angle Word 3: Computed yaw angle	185	190	i	2	3	0	degrees	

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Total Applied Attitude Correction Word 1: Roll Word 2: Pitch Word 3: Yaw	191	196	i	2	3	3	degrees	
Navigation Status Bit Field *(bits 20-18 are Metop specific and will contain zero fill for NOAA; bits 11-0 are NOAA specific and will contain zero fill for Metop)* bits 31-21: <zero fill> bit 20-19: yaw steering parameters usage indicator (0=no yaw steering correction; 1=computed parameters from Metop data stream; 2=measured parameters from Metop data stream; 3=computed parameters from AELDS) bit 18: Metop maneuver indicator (0=scan does not occur during a Metop in-plane or out-of-plane maneuver; 1=scan, or some part of it, occurs during a maneuver) bit 17: earth location at the satellite subpoint is accurate and reasonable, i.e., is within tolerance defined by "Nadir Earth Location Tolerance" in header (0=out of tolerance; 1=in tolerance) bit 16: earth location corrected for Euler angles (0=FALSE; 1=TRUE) bits 15-12: earth location indicator (0=earth location available; 1=user ephemeris files greater than 24 hours old; 2=no earth location available) bits 11-8: spacecraft attitude control (0=operating in YGC or NOMINAL mode; 1=operating in another mode; 2=attitude exceeds nominal tolerance; 3=both 1 and 2) bits 7-4: attitude SMODE (0=nominal mode; 1=rate nulling mode; 2=YGC mode; 3=search mode; 4=coast mode) bits 3-0: attitude PWTIP$AC (0=nominal mode/no test; 1=yaw axis test in progress; 2=roll axis test in progress; 3=pitch axis test in progress)	197	200	u	4	1	0		
Time Associated with Euler Angles	201	204	i	4	1	0	seconds	
Euler Angles *(NOTE: For Metop-originated AMSU-A data, this field is also referred to as the measured yaw steering parameters.)* Word 1: Roll Word 2: Pitch Word 3: Yaw	205	210	i	2	3	3	degrees	
Spacecraft Altitude above Reference Ellipsoid	211	212	u	2	1	1	kilometers	
Angular Relationships *(relative azimuth range +/- 180.00 degrees)* Word 1: Solar zenith angle, FOV 1 Word 2: Satellite zenith angle, FOV 1 Word 3: Relative azimuth angle, FOV 1 Word 4: Solar zenith angle, FOV 2 ... (set of 3 angles every FOV) ... Word 270: Relative azimuth angle, FOV 90	213	752	i	2	270	2	degrees	
Earth Location *(north latitude and east longitude are positive)* Word 1: Latitude, FOV 1 Word 2: Longitude, FOV 1 Word 3: Latitude, FOV 2 ... (lat/lon word pair every FOV) ... Word 180: Longitude, FOV 90	753	1472	i	4	180	4	degrees	
Lunar Angles *(angles between moon and individual space views; range 0 to 180.00 degrees)* Word 1: Angle between moon and space view 1 Word 2: Angle between moon and space view 2 Word 3: Angle between moon and space view 3 Word 4: Angle between moon and space view 4	1473	1480	u	2	4	2	degrees	

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
MHS SENSOR DATA *In fixed view mode, the pixel data is the same format as scan mode, but the concept of earth, space, and OBCT views does not apply. All 98 views (i.e., 90 earth + 4 space + 4 OBCT) are for the fixed view position.*								
Scene (Earth View) Data *(range: 0 - 65,535)* Word 1: Mid-pixel position for FOV 1 Word 2: Scene counts for FOV 1, channel H1 Word 3: Scene counts for FOV 1, channel H2 Word 4: Scene counts for FOV 1, channel H3 Word 5: Scene counts for FOV 1, channel H4 Word 6: Scene counts for FOV 1, channel H5 Word 7: Mid-pixel position for FOV 2 Words 8-12: Scene counts for FOV 2, channels H1-H5 (in order) ... (6 words for every FOV) ... Word 535: Mid-pixel position for FOV 90 Words 536-540: Scene counts for FOV 90, channels H1-H5 (in order)	1481	2560	u	2	540	0	counts	
<Zero Fill>	2561	2568	i	4	2	0		
CALIBRATION DATA								
Space View Data *(range: 0 - 65,535)* Word 1: Mid-pixel position for space view 1 Word 2: Counts for space view 1, channel H1 Word 3: Counts for space view 1, channel H2 Word 4: Counts for space view 1, channel H3 Word 5: Counts for space view 1, channel H4 Word 6: Counts for space view 1, channel H5 Word 7: Mid-pixel position for space view 2 Word 8-12: Counts for space view 2, channel H1-H5 (in order) Word 13: Mid-pixel position for space view 3 Word 14-18: Counts for space view 3, channel H1-H5 (in order) Word 19: Mid-pixel position for space view 4 Word 20-24: Counts for space view 4, channel H1-H5 (in order)	2569	2616	u	2	24	0	counts	
OBCT View Data *(range: 0 - 65,535)* Word 1: Mid-pixel position for OBCT view 1 Word 2: Counts for OBCT view 1, channel H1 Word 3: Counts for OBCT view 1, channel H2 Word 4: Counts for OBCT view 1, channel H3 Word 5: Counts for OBCT view 1, channel H4 Word 6: Counts for OBCT view 1, channel H5 Word 7: Mid-pixel position for OBCT view 2 Word 8-12: Counts for OBCT view 2, channel H1-H5 (in order) Word 13: Mid-pixel position for OBCT view 3 Word 14-18: Counts for OBCT view 3, channel H1-H5 (in order) Word 19: Mid-pixel position for OBCT view 4 Word 20-24: Counts for OBCT view 4, channel H1-H5 (in order)	2617	2664	u	2	24	0	counts	
<Zero Fill>	2665	2672	i	4	2	0		
POSITION VALIDITY FLAGS *There is one bit flag for each FOV (earth, space, and OBCT). If bit flag = 0, then mid-pixel antenna position for corresponding FOV is within its nominal range. Otherwise (if = 1), position is outside of its nominal range.*								
Earth View Position Validity Flags Word 1: position flags for FOVs 1-8 (bits 0-7) Word 2: position flags for FOVs 9-16 (bits 0-7) ... Word 11: position flags for FOVs 81-88 (bits 0-7) Word 12: position flags for FOVs 89-90 (bits 0-1; bits 2-7 are <zero fill>)	2673	2684	u	1	12	0		2

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Space View Position Validity Flags bits 7-4: <zero fill> bit 3: position flag for space view 4 bit 2: position flag for space view 3 bit 1: position flag for space view 2 bit 0: position flag for space view 1	2685	2685	u	1	1	0		3
OBCT View Position Validity Flags bits 7-4: <zero fill> bit 3: position flag for OBCT view 4 bit 2: position flag for OBCT view 3 bit 1: position flag for OBCT view 2 bit 0: position flag for OBCT view 1	2686	2686	u	1	1	0		3
FULL HOUSEKEEPING DATA								
Mode and Sub-commutation Code bits 7-4: mode code (0=power on; 1=warm up; 2=stand by; 3=scan; 4=fixed view; 5=self test; 6=safeing; 7=fault; 8-14=<unused>; 15=memory data packet ID) bit 3: PIE ID (0=PIE A; 1=PIE B) bits 2-0: sub-commutation code *(only meaningful for telemetry packet data)*	2687	2687	u	1	1	0		
Telecommand Acknowledgement and Fault Code *Words 1-2:* bit 15: TC clean (1=no parity or checksum error found in received packet) bit 14: TC conforms (1=header of received command conforms to the CCSDS format) bit 13: TC recognized (1=received command is a recognized MHS command of the correct format) bit 12: TC legal (1=received command is legal for execution in the current MHS operating mode) bit 11: FDM motor current trip status (1=instantaneous current in the FDM motor has exceeded a pre-set level, resulting in the disabling of the FDM motor drive circuit) bits 10-0: TC application ID (taken from the packet ID field of the primary header of the received serial command) *Words 3-4:* bits 15-2: TC packet sequence count bits 1-0: TC received count *Word 5:* bit 7: current monitor fault (1=one or more PSU current monitor parameters exceed their expected limits); see note 4 bit 6: thermistor monitor fault (1=one or more thermistor temperature monitor parameters exceed their expected limits); see note 4 bit 5: switch fault (1=a switch status telemetry parameter does not agree with its last commanded state, or a PROM board switch error has occurred) bit 4: processor fault (1=a processor internal fault has occurred (overflow, illegal address, BIT failure)) bit 3: RDM motor current trip status (1=instantaneous current in the RDM motor has exceeded a pre-set level, resulting in the disabling of the RDM motor drive circuit) bit 2: DC offset error (1=one or more channel calibration target's readings indicate a change in the DC offset is required) bit 1: scan control error (1=the measured mid-pixel position of the reflector during earth, space, or OBCT views is outside the limits for the scan mode profile, or the reflector position is outside the limits of the requested position for fixed view mode, or the position acquisition initialization has failed); see note 5 bit 0: REF CK error (1=scan control clock stops as a result of the platform reference clock stopping for a period of >= 2.5 ms)	2688	2692	u	1	5	0		4,5

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Switch Status *Word 1:* bit 7: receiver channel H4 backend (0=off; 1=on) bit 6: receiver channel H3 backend (0=off; 1=on) bit 5: receiver channel H3/H4 local oscillator selected (0=A; 1=B) bit 4: receiver channel H3/H4 front-end (0=off; 1=on) bit 3: receiver channel H2 local oscillator selected (0=A; 1=B) bit 2: receiver channel H2 (0=off; 1=on) bit 1: receiver channel H1 local oscillator selected (0=A; 1=B) bit 0: receiver channel H1 (0=off; 1=on) *Word 2:* bit 7: PROM (1=a PROM segment switch has failed ON) bit 6: signal processing electronics/scan control electronics (0=off; 1=on) bit 5: auxiliary operational heaters (0=off; 1=on) bit 4: scan mechanism operational heaters (0=off; 1=on) bit 3: receiver operational heaters (0=off; 1=on) bit 2: Rx CV (0=off; 1=on) bit 1: receiver channel H5 local oscillator selected (0=A; 1=B) bit 0: receiver channel H5 (0=off; 1=on) *Word 3:* bit 7: FDM motor current trip status (0=enabled; 1=disabled) bit 6: RDM motor current trip status (0=enabled; 1=disabled) bit 5: FDM motor supply (0=off; 1=on) bit 4: RDM motor supply (0=off; 1=on) bit 3: FDM motor sensors selected (0=A; 1=B) bit 2: RDM motor sensors selected (0=A; 1=B) bit 1: FDM zero position sensors (0=A; 1=B) bit 0: RDM zero position sensors (0=A; 1=B)	2693	2695	u	1	3	0		
Temperature Data *(range: 0-255)* Word 1: LO H1 temperature Word 2: LO H2 temperature Word 3: LO H3/H4 temperature Word 4: LO H5 temperature Word 5: Mixer/LNA/Multiplexer H1 temperature Word 6: Mixer/LNA/Multiplexer H2 temperature Word 7: Mixer/LNA/Multiplexer H3/H4 temperature Word 8: Mixer/LNA/Multiplexer H5 temperature Word 9: Quasi-optics baseplate temperature #1 (dichroic D1(A) or polarisor(B)) Word 10: Quasi-optics baseplate temperature #2 (dichroic D2(A) or mirror(B)) Word 11: IF baseplate temperature #1 Word 12: IF baseplate temperature #2 Word 13: Scan mechanism core temperature Word 14: Scan mechanism housing temperature Word 15: RDM SSHM temperature Word 16: FDM SSHM temperature Word 17: Structure 1 temperature (-A edge, next to baseplate cutout) Word 18: Structure 2 temperature (-A edge, in-between Rx and SM) Word 19: Structure 3 temperature (-V edge, in-between EE and SM) Word 20: Processor module temperature Word 21: Main DC/DC converter module temperature Word 22: SCE RDM module temperature Word 23: SCE FDM module temperature Word 24: RF DC/DC converter module temperature	2696	2719	u	1	24	0	counts	
Raw Current Consumption Data *(internal PSU current analog telemetry; range: 0-255)* Word 1: EE and SM +5V current Word 2: receiver +8V current Word 3: receiver +15V current Word 4: receiver -15V current Word 5: RDM motor current Word 6: FDM motor current	2720	2725	u	1	6	0	counts	
<Zero Fill>	2726	2726	i	1	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
STATUS WORD								
Status Word bit 7: DC offset valid (1=all channels' calibration target's readings lie within acceptable limits) bit 6: scan control valid: only set in scan mode or fixed view mode (1=all mid-pixel positions of the reflector during earth, space, or OBCT views are within limits) bits 5-4: profile (0=profile 0--the nominal scan mode profile with nominal space view position; 1=profile 1--alternate space view position; 2=profile 2--alternate space view position; 3=no profile calculated--profile will be manually loaded and modified) bits 3-0: <unused>	2727	2727	u	1	1	0		
<Zero Fill>	2728	2734	i	1	7	0		
SIGNAL PROCESSING STATUS								
DC Offset Words *(range: 0-255)* Word 1: Channel H1 DC offset word Word 2: Channel H2 DC offset word Word 3: Channel H3 DC offset word Word 4: Channel H4 DC offset word Word 5: Channel H5 DC offset word	2735	2739	u	1	5	0	counts	
Channel Valid Flags bit 7: H1 valid (1=all samples of channel H1 for this scan lie within the ADC dynamic range) bit 6: H2 valid (1=all samples of channel H2 for this scan lie within the ADC dynamic range) bit 5: H3 valid (1=all samples of channel H3 for this scan lie within the ADC dynamic range) bit 4: H4 valid (1=all samples of channel H4 for this scan lie within the ADC dynamic range) bit 3: H5 valid (1=all samples of channel H5 for this scan lie within the ADC dynamic range) bits 2-0: SPE MUX code (0=channel H1 connected to SPE 6; 1=H2 to SPE 6; 2=H3 to SPE 6; 3=SPE 6 not used; 4=H4 to SPE 6; 5=H5 to SPE 6; 6=SPE 6 not used; 7=SPE 6 not used)	2740	2740	u	1	1	0		
Channel Gain *(i.e., gain setting of the receiver video output channels)* *Values of 0 to 3 imply 0 db gain to 3 dB gain, respectively. Values of 4 to 7 are not used.* *Word 1:* bits 7-5: channel H1 gain bits 4-2: channel H2 gain bits 1-0: <unused> *Word 2:* bits 7-5: channel H3 gain bits 4-2: channel H4 gain bits 1-0: <unused> *Word 3:* bits 7-5: channel H5 gain bits 4-2: <unused> bits 1-0: <unused>	2741	2743	u	1	3	0		
<Zero Fill>	2744	2750	i	1	7	0		
OBCT TEMPERATURE DATA								
OBCT (PRT) Readings Word 1: PRT 1 Word 2: PRT 2 Word 3: PRT 3 Word 4: PRT 4 Word 5: PRT 5	2751	2760	u	2	5	0	counts	
PRT Calibration Channels Word 1: Calibration channel 1 (upper value) Word 2: Calibration channel 2 (middle value) Word 3: Calibration channel 3 (lower value)	2761	2766	u	2	3	0	counts	
<Zero Fill>	2767	2768	i	2	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Computed OBCT Temperatures Word 1: OBCT temperature 1 (based on PRT 1 reading) Word 2: OBCT temperature 2 (based on PRT 2 reading) Word 3: OBCT temperature 3 (based on PRT 3 reading) Word 4: OBCT temperature 4 (based on PRT 4 reading) Word 5: OBCT temperature 5 (based on PRT 5 reading)	2769	2788	u	4	5	3	K	
SPARES								
Science Packet Spare Words *(set to zero)*	2789	2833	u	1	45	0		
<Zero Fill>	2834	2834	i	1	1	0		
DISCRETE TELEMETRY *Equivalent to digital B and analog housekeeping telemetry in other instruments.*								1
Main Bus Select Status *(indicate which main bus (A or B) is used by the MHS)* 1 (0V)=A bus (relay closed) 0 (5V)=B bus (relay opened)	2835	2835	u	1	1	0		
MHS Survival Heater *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=on 0=off	2836	2836	u	1	1	0		
RF Converter Protect Disable *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=no 0=yes	2837	2837	u	1	1	0		
MHS Power A *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=on 0=off	2838	2838	u	1	1	0		
MHS Power B *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=on 0=off	2839	2839	u	1	1	0		
Main Converter Protect Disable *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=no 0=yes	2840	2840	u	1	1	0		
Survival Temperatures Word 1: Receiver temperature Word 2: Electronics equipment temperature Word 3: Scan mechanism temperature	2841	2846	u	2	3	0	counts	
Transmitter Telemetry *(NOAA: content defined below)* or <Zero Fill> *(Metop)* Word 1: STX-1 status Word 2: STX-2 status Word 3: STX-3 status Word 4: STX-4 status Word 5: STX-1 power Word 6: STX-2 power Word 7: STX-3 power Word 8: SARR-A power Word 9: SARR-B power	2847	2864	u	2	9	0	counts	

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Discrete Telemetry Update Flags *(If bit = 0, associated telemetry item is up-to-date. If bit = 1, associated telemetry item was not updated during most recent telemetry cycle - possibly due to lost frame.)* bits 31-18: <zero fill> bit 17: SARR-B power (NOAA) or <zero fill> (Metop) bit 16: SARR-A power (NOAA) or <zero fill> (Metop) bit 15: STX-3 power (NOAA) or <zero fill> (Metop) bit 14: STX-2 power (NOAA) or <zero fill> (Metop) bit 13: STX-1 power (NOAA) or <zero fill> (Metop) bit 12: STX-4 status (NOAA) or <zero fill> (Metop) bit 11: STX-3 status (NOAA) or <zero fill> (Metop) bit 10: STX-2 status (NOAA) or <zero fill> (Metop) bit 9: STX-1 status (NOAA) or <zero fill> (Metop) bit 8: Scan mechanism temperature bit 7: Electronics equipment temperature bit 6: Receiver temperature bit 5: Main converter protect disable (NOAA) or <zero fill> (Metop) bit 4: MHS power B (NOAA) or <zero fill> (Metop) bit 3: MHS power A (NOAA) or <zero fill> (Metop) bit 2: RF converter protect disable (NOAA) or <zero fill> (Metop) bit 1: MHS survival heater (NOAA) or <zero fill> (Metop) bit 0: Main bus select status	2865	2868	u	1	4	0		
FILLER								
<Zero Fill>	2869	3072	i	2	102	0		

Notes: 1, 2, 3, 4

6.3 MHS 1b Data Record Format (Extended Test Data Packet)

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
SCAN LINE INFORMATION								
Scan Line Number *(cumulative, starting with 1)*	1	2	u	2	1	0		
Scan Line Year *(four digits, e.g., 2000)*	3	4	u	2	1	0		
Scan Line Day of Year *(e.g., 365)*	5	6	u	2	1	0		
Satellite Clock Drift Delta	7	8	i	2	1	0	milliseconds	
Scan Line UTC Time of Day	9	12	u	4	1	0	milliseconds	
Scan Line Bit Field bit 15: satellite direction (0=northbound; 1=southbound) bit 14: clock drift correction (0=not corrected; 1=scan time corrected for clock drift) bits 13-0: <zero fill>	13	14	u	2	1	0		
Major Frame Count *(cumulative, starting with 1) (NOAA)* or <Zero Fill> *(Metop)*	15	16	u	2	1	0		
Coarse MHS On-board Time (OBT) *(time since last reset to zero)*	17	20	u	4	1	0	seconds	
Fine MHS OBT *(fraction of second since last increment of coarse MHS OBT. Resolution: 2^{-16} seconds; range: 0 - 65,535.)*	21	22	u	2	1	0		
MHS Mode Flag 0=power-on ("empty" MHS science data) 1=warm-up ("empty" MHS science data) 2=standby ("empty" MHS science data) 3=scan (valid MHS science data) 4=fixed view (valid MHS science data, but instrument is viewing a fixed location) 5=self-test (test data) 6=safeing ("empty" MHS science data) 7=fault ("empty" MHS science data) 8-14=<undefined> (unknown data) 15=memory dump (memory dump data)	23	23	u	1	1	0		
<Zero Fill>	24	24	i	1	1	0		
QUALITY INDICATORS								
Quality Indicator Bit Field *(if a bit is on (=1), the statement is true)* bit 31: do not use scan for product generation bit 30: time sequence error detected within this scan (see below) bit 29: data gap precedes this scan (gap may be due to actual lost scans or scans in which the TIP or MIU are in non-nominal modes) bit 28: insufficient data for calibration (see below) bit 27: earth location data not available (see below) bit 26: first good time following a clock update (nominally 0) bit 25: instrument status changed with this scan bits 24 - 5: <zero fill> bit 4: transmitter status change occurred (see note 2) bit 3: AMSU sync error detected (NOAA) or <zero fill> (Metop) bit 2: AMSU minor frame error detected (NOAA) or <zero fill> (Metop) bit 1: AMSU major frame error detected (NOAA) or <zero fill> (Metop) bit 0: AMSU parity error detected (NOAA) or <zero fill> (Metop)	25	28	u	4	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Scan Line Quality Flags [Time Problem Code] *(If a bit is on (=1), the statement is true. All bits off implies the scan time is as expected.)* bit 7: time field is bad but can probably be inferred from the previous good time bit 6: time field is bad and can't be inferred from the previous good time bit 5: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may be associated with a spacecraft clock update. (See bit 26, Quality Indicator Bit Field.) bit 4: start of a sequence that apparently repeats scan times that have been previously accepted bits 3-0: <zero fill>	29	29	u	1	1	0		
<Zero Fill>	30	1480	i	1	1451	0		
EXTENDED TEST DATA PACKET								
Mode Code/PIE ID/Self-Test Code bits 7-4: mode code (5=self test) bit 3: PIE ID (0=PIE A; 1=PIE B) bits 2-0: self-test code	1481	1481	u	1	1	0		
Unused *(set to zero)*	1482	1519	u	1	38	0		
Extended Test Data	1520	2766	u	1	1247	0		(6) → 3
<Zero Fill>	2767	2834	i	2	34	0		
DISCRETE TELEMETRY *Equivalent to digital B and analog housekeeping telemetry in other instruments.*								1
Main Bus Select Status *(indicate which main bus (A or B) is used by the MHS)* 1 (0V)=A bus (relay closed) 0 (5V)=B bus (relay opened)	2835	2835	u	1	1	0		
MHS Survival Heater *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=on 0=off	2836	2836	u	1	1	0		
RF Converter Protect Disable *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=no 0=yes	2837	2837	u	1	1	0		
MHS Power A *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=on 0=off	2838	2838	u	1	1	0		
MHS Power B *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=on 0=off	2839	2839	u	1	1	0		
Main Converter Protect Disable *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=no 0=yes	2840	2840	u	1	1	0		
Survival Temperatures Word 1: Receiver temperature Word 2: Electronics equipment temperature Word 3: Scan mechanism temperature	2841	2846	u	2	3	0	counts	

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Transmitter Telemetry *(NOAA: content defined below)* or <Zero Fill> *(Metop)* Word 1: STX-1 status Word 2: STX-2 status Word 3: STX-3 status Word 4: STX-4 status Word 5: STX-1 power Word 6: STX-2 power Word 7: STX-3 power Word 8: SARR-A power Word 9: SARR-B power	2847	2864	u	2	9	0	counts	
Discrete Telemetry Update Flags *(If bit = 0, associated telemetry item is up-to-date. If bit = 1, associated telemetry item was not updated during most recent telemetry cycle - possibly due to lost frame.)* bits 31-18: <zero fill> bit 17: SARR-B power (NOAA) or <zero fill> (Metop) bit 16: SARR-A power (NOAA) or <zero fill> (Metop) bit 15: STX-3 power (NOAA) or <zero fill> (Metop) bit 14: STX-2 power (NOAA) or <zero fill> (Metop) bit 13: STX-1 power (NOAA) or <zero fill> (Metop) bit 12: STX-4 status (NOAA) or <zero fill> (Metop) bit 11: STX-3 status (NOAA) or <zero fill> (Metop) bit 10: STX-2 status (NOAA) or <zero fill> (Metop) bit 9: STX-1 status (NOAA) or <zero fill> (Metop) bit 8: Scan mechanism temperature bit 7: Electronics equipment temperature bit 6: Receiver temperature bit 5: Main converter protect disable (NOAA) or <zero fill> (Metop) bit 4: MHS power B (NOAA) or <zero fill> (Metop) bit 3: MHS power A (NOAA) or <zero fill> (Metop) bit 2: RF converter protect disable (NOAA) or <zero fill> (Metop) bit 1: MHS survival heater (NOAA) or <zero fill> (Metop) bit 0: Main bus select status	2865	2868	u	1	4	0		
FILLER								
<Zero Fill>	2869	3072	i	2	102	0		

← How come SARR-B / A } does not have status bit?

" " STX-4 does not have power bit?

Notes 1, 2, 6

6.4 MHS 1b Data Record Format (Extended Memory Data Packet)

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
SCAN LINE INFORMATION								
Scan Line Number *(cumulative, starting with 1)*	1	2	u	2	1	0		
Scan Line Year *(four digits, e.g., 2000)*	3	4	u	2	1	0		
Scan Line Day of Year *(e.g., 365)*	5	6	u	2	1	0		
Satellite Clock Drift Delta	7	8	i	2	1	0	milliseconds	
Scan Line UTC Time of Day	9	12	u	4	1	0	milliseconds	
Scan Line Bit Field bit 15: satellite direction (0=northbound; 1=southbound) bit 14: clock drift correction (0=not corrected; 1=scan time corrected for clock drift) bits 13-0: <zero fill>	13	14	u	2	1	0		
Major Frame Count *(cumulative, starting with 1) (NOAA)* or <Zero Fill> *(Metop)*	15	16	u	2	1	0		
Coarse MHS On-board Time (OBT) *(time since last reset to zero)*	17	20	u	4	1	0	seconds	
Fine MHS OBT *(fraction of second since last increment of coarse MHS OBT. Resolution: 2^{-16} seconds; range: 0 - 65,535.)*	21	22	u	2	1	0		
MHS Mode Flag 0=power-on ("empty" MHS science data) 1=warm-up ("empty" MHS science data) 2=standby ("empty" MHS science data) 3=scan (valid MHS science data) 4=fixed view (valid MHS science data, but instrument is viewing a fixed location) 5=self-test (test data) 6=safeing ("empty" MHS science data) 7=fault ("empty" MHS science data) 8-14=<undefined> (unknown data) 15=memory dump (memory dump data)	23	23	u	1	1	0		
<Zero Fill>	24	24	i	1	1	0		
QUALITY INDICATORS								
Quality Indicator Bit Field *(if a bit is on (=1), the statement is true)* bit 31: do not use scan for product generation bit 30: time sequence error detected within this scan (see below) bit 29: data gap precedes this scan (gap may be due to actual lost scans or scans in which the TIP or MIU are in non-nominal modes) bit 28: insufficient data for calibration (see below) bit 27: earth location data not available (see below) bit 26: first good time following a clock update (nominally 0) bit 25: instrument status changed with this scan bits 24 - 5: <zero fill> bit 4: transmitter status change occurred (see note 2) bit 3: AMSU sync error detected (NOAA) or <zero fill> (Metop) bit 2: AMSU minor frame error detected (NOAA) or <zero fill> (Metop) bit 1: AMSU major frame error detected (NOAA) or <zero fill> (Metop) bit 0: AMSU parity error detected (NOAA) or <zero fill> (Metop)	25	28	u	4	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Scan Line Quality Flags [Time Problem Code] *(If a bit is on (=1), the statement is true. All bits off implies the scan time is as expected.)* bit 7: time field is bad but can probably be inferred from the previous good time bit 6: time field is bad and can't be inferred from the previous good time bit 5: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may be associated with a spacecraft clock update. (See bit 26, Quality Indicator Bit Field.) bit 4: start of a sequence that apparently repeats scan times that have been previously accepted bits 3-0: <zero fill>	29	29	u	1	1	0		
<Zero Fill>	30	1480	i	1	1451	0		
EXTENDED MEMORY DATA PACKET								
Packet ID/PIE ID bits 7-4: packet ID (15=memory data packet) bit 3: PIE ID (0=PIE A; 1=PIE B) bits 2-0: unused (undefined)	1481	1481	u	1	1	0		
Start Address *(where, word 1 is the most significant byte of address and word 3 is the least significant byte)*	1482	1484	u	1	3	0		7
Data Words	1485	2508	u	2	512	0		7
<Zero Fill>	2509	2834	i	2	163	0		
DISCRETE TELEMETRY *Equivalent to digital B and analog housekeeping telemetry in other instruments.*								1
Main Bus Select Status *(indicate which main bus (A or B) is used by the MHS)* 1 (0V)=A bus (relay closed) 0 (5V)=B bus (relay opened)	2835	2835	u	1	1	0		
MHS Survival Heater *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=on 0=off	2836	2836	u	1	1	0		
RF Converter Protect Disable *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=no 0=yes	2837	2837	u	1	1	0		
MHS Power A *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=on 0=off	2838	2838	u	1	1	0		
MHS Power B *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=on 0=off	2839	2839	u	1	1	0		
Main Converter Protect Disable *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=no 0=yes	2840	2840	u	1	1	0		
Survival Temperatures Word 1: Receiver temperature Word 2: Electronics equipment temperature Word 3: Scan mechanism temperature	2841	2846	u	2	3	0	counts	

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Transmitter Telemetry *(NOAA: content defined below)* or <Zero Fill> *(Metop)* Word 1: STX-1 status Word 2: STX-2 status Word 3: STX-3 status Word 4: STX-4 status Word 5: STX-1 power Word 6: STX-2 power Word 7: STX-3 power Word 8: SARR-A power Word 9: SARR-B power	2847	2864	u	2	9	0	counts	
Discrete Telemetry Update Flags *(If bit = 0, associated telemetry item is up-to-date. If bit = 1, associated telemetry item was not updated during most recent telemetry cycle - possibly due to lost frame.)* bits 31-18: <zero fill> bit 17: SARR-B power (NOAA) or <zero fill> (Metop) bit 16: SARR-A power (NOAA) or <zero fill> (Metop) bit 15: STX-3 power (NOAA) or <zero fill> (Metop) bit 14: STX-2 power (NOAA) or <zero fill> (Metop) bit 13: STX-1 power (NOAA) or <zero fill> (Metop) bit 12: STX-4 status (NOAA) or <zero fill> (Metop) bit 11: STX-3 status (NOAA) or <zero fill> (Metop) bit 10: STX-2 status (NOAA) or <zero fill> (Metop) bit 9: STX-1 status (NOAA) or <zero fill> (Metop) bit 8: Scan mechanism temperature bit 7: Electronics equipment temperature bit 6: Receiver temperature bit 5: Main converter protect disable (NOAA) or <zero fill> (Metop) bit 4: MHS power B (NOAA) or <zero fill> (Metop) bit 3: MHS power A (NOAA) or <zero fill> (Metop) bit 2: RF converter protect disable (NOAA) or <zero fill> (Metop) bit 1: MHS survival heater (NOAA) or <zero fill> (Metop) bit 0: Main bus select status	2865	2868	u	1	4	0		
FILLER								
<Zero Fill>	2869	3072	i	2	102	0		

Notes: 1, 2, 7

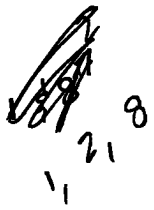
6.5 MHS 1b Data Record Format ("Unknown" Packet)

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
SCAN LINE INFORMATION								
Scan Line Number *(cumulative, starting with 1)*	1	2	u	2	1	0		
Scan Line Year *(four digits, e.g., 2000)*	3	4	u	2	1	0		
Scan Line Day of Year *(e.g., 365)*	5	6	u	2	1	0		
Satellite Clock Drift Delta	7	8	i	2	1	0	milliseconds	
Scan Line UTC Time of Day	9	12	u	4	1	0	milliseconds	
Scan Line Bit Field bit 15: satellite direction (0=northbound; 1=southbound) bit 14: clock drift correction (0=not corrected; 1=scan time corrected for clock drift) bits 13-0: <zero fill>	13	14	u	2	1	0		
Major Frame Count *(cumulative, starting with 1) (NOAA)* or <Zero Fill> *(Metop)*	15	16	u	2	1	0		
Coarse MHS On-board Time (OBT) *(time since last reset to zero)*	17	20	u	4	1	0	seconds	
Fine MHS OBT *(fraction of second since last increment of coarse MHS OBT. Resolution: 2^{-16} seconds; range: 0 - 65,535.)*	21	22	u	2	1	0		
MHS Mode Flag 0=power-on ("empty" MHS science data) 1=warm-up ("empty" MHS science data) 2=standby ("empty" MHS science data) 3=scan (valid MHS science data) 4=fixed view (valid MHS science data, but instrument is viewing a fixed location) 5=self-test (test data) 6=safeing ("empty" MHS science data) 7=fault ("empty" MHS science data) 8-14=<undefined> (unknown data) 15=memory dump (memory dump data)	23	23	u	1	1	0		
<Zero Fill>	24	24	i	1	1	0		
QUALITY INDICATORS								
Quality Indicator Bit Field *(if a bit is on (=1), the statement is true)* bit 31: do not use scan for product generation bit 30: time sequence error detected within this scan (see below) bit 29: data gap precedes this scan (gap may be due to actual lost scans or scans in which the TIP or MIU are in non-nominal modes) bit 28: insufficient data for calibration (see below) bit 27: earth location data not available (see below) bit 26: first good time following a clock update (nominally 0) bit 25: instrument status changed with this scan bits 24 - 5: <zero fill> bit 4: transmitter status change occurred (see note 2) bit 3: AMSU sync error detected (NOAA) or <zero fill> (Metop) bit 2: AMSU minor frame error detected (NOAA) or <zero fill> (Metop) bit 1: AMSU major frame error detected (NOAA) or <zero fill> (Metop) bit 0: AMSU parity error detected (NOAA) or <zero fill> (Metop)	25	28	u	4	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Scan Line Quality Flags [Time Problem Code] *(If a bit is on (=1), the statement is true. All bits off implies the scan time is as expected.)* bit 7: time field is bad but can probably be inferred from the previous good time bit 6: time field is bad and can't be inferred from the previous good time bit 5: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may be associated with a spacecraft clock update. (See bit 26, Quality Indicator Bit Field.) bit 4: start of a sequence that apparently repeats scan times that have been previously accepted bits 3-0: <zero fill>	29	29	u	1	1	0		
<Zero Fill>	30	1480	i	1	1451	0		
UNKNOWN PACKET DATA								
Packet Data	1481	2766	u	1	1286	0		8
<Zero Fill>	2767	2834	i	2	34	0		
DISCRETE TELEMETRY *Equivalent to digital B and analog housekeeping telemetry in other instruments.*								1
Main Bus Select Status *(indicate which main bus (A or B) is used by the MHS)* 1 (0V)=A bus (relay closed) 0 (5V)=B bus (relay opened)	2835	2835	u	1	1	0		
MHS Survival Heater *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=on 0=off	2836	2836	u	1	1	0		
RF Converter Protect Disable *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=no 0=yes	2837	2837	u	1	1	0		
MHS Power A *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=on 0=off	2838	2838	u	1	1	0		
MHS Power B *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=on 0=off	2839	2839	u	1	1	0		
Main Converter Protect Disable *(NOAA: content defined at right)* or <Zero Fill> *(Metop)* 1=no 0=yes	2840	2840	u	1	1	0		
Survival Temperatures Word 1: Receiver temperature Word 2: Electronics equipment temperature Word 3: Scan mechanism temperature	2841	2846	u	2	3	0	counts	
Transmitter Telemetry *(NOAA: content defined below)* or <Zero Fill> *(Metop)* Word 1: STX-1 status Word 2: STX-2 status Word 3: STX-3 status Word 4: STX-4 status Word 5: STX-1 power Word 6: STX-2 power Word 7: STX-3 power Word 8: SARR-A power Word 9: SARR-B power	2847	2864	u	2	9	0	counts	

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Discrete Telemetry Update Flags *(If bit = 0, associated telemetry item is up-to-date. If bit = 1, associated telemetry item was not updated during most recent telemetry cycle - possibly due to lost frame.)* bits 31-18: <zero fill> bit 17: SARR-B power (NOAA) or <zero fill> (Metop) bit 16: SARR-A power (NOAA) or <zero fill> (Metop) bit 15: STX-3 power (NOAA) or <zero fill> (Metop) bit 14: STX-2 power (NOAA) or <zero fill> (Metop) bit 13: STX-1 power (NOAA) or <zero fill> (Metop) bit 12: STX-4 status (NOAA) or <zero fill> (Metop) bit 11: STX-3 status (NOAA) or <zero fill> (Metop) bit 10: STX-2 status (NOAA) or <zero fill> (Metop) bit 9: STX-1 status (NOAA) or <zero fill> (Metop) bit 8: Scan mechanism temperature bit 7: Electronics equipment temperature bit 6: Receiver temperature bit 5: Main converter protect disable (NOAA) or <zero fill> (Metop) bit 4: MHS power B (NOAA) or <zero fill> (Metop) bit 3: MHS power A (NOAA) or <zero fill> (Metop) bit 2: RF converter protect disable (NOAA) or <zero fill> (Metop) bit 1: MHS survival heater (NOAA) or <zero fill> (Metop) bit 0: Main bus select status	2865	2868	u	1	4	0		
FILLER								
<Zero Fill>	2869	3072	i	2	102	0		

Notes



7 TBCs/TBDs

TBC1: The values of the "Spacecraft Identification Code" field in the header record for the Metop satellites, and their origin.

TBD1: The content and format of the secondary header record.
TBD2: The necessity of bias correction data, including transmitter telemetry, for the Metop satellites (and the NOAA satellites, for that matter).
TBD3: The unit of measure, scale factor, and content of the "Change in Spacecraft Velocity" field in the header record.
TBD4: The unit of measure and scale factor of the "Spacecraft Mass" field in the header record.

~~7~~8 Notes

~~1)~~1. The MHS 1b will not contain any MIU-related analog or digital B telemetry items from the NOAA data stream. These items will be archived in a separate NOAA telemetry file.

2. The RFI/bias correction data is based on experience with the AMSU-B instrument from the NOAA-KLM series of satellites. While it may not be necessary, it is being left in the MHS 1b format. Until a determination is made that it is necessary, it will be zero filled.

3. To determine the word location and bit location within the word of a particular FOV's validity flag, use the following equations:
   word = truncate((FOV - 1) / 8) + 1
   bit = (FOV - 1) mod 8

   For example, FOV 64's validity flag is located in bit 7 of word 8, computed as follows:
   word = truncate((64 - 1) / 8) + 1 = truncate(63 / 8) + 1 = truncate(7.875) + 1 = 7 + 1 = 8
   bit = (64 - 1) mod 8 = 63 mod 8 = 7

~~4)~~4. The limits are defined in the Telemetry Limits Table, which is loaded into the instrument's memory. This table can be found in Appendix B of AD-1, and in Table 3.2.2.2.9-3 of AD-2. There are two levels of limits: "warning" limits and "fault" limits. If a telemetry item goes outside of the "warning" limits, then this bit is set. If the telemetry item goes outside of the "fault" limits, then an error flag is raised in the "fault code" field and the instrument switches to "fault" mode.

~~5)~~5. This bit is related to the Earth/Space/OBCT View Position Validity Flags. It is set by the instrument and comes in the data stream. The Position Validity Flags are set by the preprocessor. If this bit is set, then at least one bit of the Position Validity Flags should be set also.

~~6)~~6. Refer to Section 4.3.2.3 of AD-1 for a detailed description of the content of this field.

7. Refer to Section 4.3.2.2 of AD-1 for a detailed description of the content of this field.

8. The mode of the instrument--and therefore the type of packet--is unknown if the mode code in the data stream is either missing (due to a missing minor frame, for example) or corrupt (i.e., set to one of the "unused" values). In the event of an unknown mode/packet, the packet data is placed into this field without modification."

89 Acronyms

ADC	Analog-to-Digital Converter
AMSU	Advanced Microwave Sounding Unit
AELDS	Advanced Earth Location System
AIP	AMSU Instrument Processor
AU	Astronomical Unit
CCSDS	Consultative Committee for Space Data Systems
cm	centimeter
CPIDS	Calibration Parameters Input Data Set
dB	Decibel
DC	(1) Direct Current; (2) Down Converter (part of Rx)
EE	Electronics Equipment
EM	Engineering Model
FDM	Flywheel Drive Mechanism/Module (part of SM)
FM	Flight Model
FOV	Field Of View
GAC	Global Area Coverage
HRPT	High Resolution Picture Transmission
IF	Intermediate Frequency
IJPS	Initial Joint Polar-orbiting Operational Satellite System
K	Kelvin
km	kilometer
LAC	Local Area Coverage
LNA	Low Noise Amplifiers (part of Rx)
LO	Local Oscillator; also known as QBS (part of Rx)
m	(1) meter; (2) milli-
Metop	Meteorological Operational Satellite
MHS	Microwave Humidity Sounder
MIU	MHS Interface Unit
MUX	Multiplexer
NOAA	National Oceanic and Atmospheric Administration
OBCT	On-Board Calibration Target
OBT	On-Board Time
PACS	Polar Acquisition and Control Subsystem
PFM	Proto-Flight Model
PIE	Processor and Interface Electronics
PROM	Programmable Read Only Memory
PRT	Platinum Resistance Thermometer
PSU	Power Supply Unit
QBS	Q-band Source (part of Rx)
RDM	Reflector Drive Mechanism/Module (part of SM)
REF CK	Reference Clock

RF	Radio Frequency
RFI	RF Interference
Rx CV	Receiver Converter
SAIP	Stored AIP
SARR	Search and Rescue Repeater
SCE	Scan Control Electronics (part of EE)
SM	Scan Mechanism
SOCC	Satellite Operations Control Center
SPE	Signal Processing Electronics (part of EE)
sr	steradian
SSHM	Scan Sensor Head Module (part of SM)
STIP	Stored TIP
STX	S-band Transmitter
TBC	To Be Confirmed
TBD	To Be Determined
TC	Telecommand
TIP	TIROS Information Processor
UTC	Universal Time Coordinated
V	Volts
W	Watts
YGC	Yaw Gyrocompassing